

CLAIMS

- 1 1. A fluid controlling assembly for use in a direct oxidation fuel cell, which fuel cell
2 has an anode chamber and a cathode chamber, the assembly comprising:
3 an adjustable component at least a portion of which is disposed within the cathode
4 chamber of the fuel cell, and said component, when adjusted, regulates the rate at which
5 fluids travel into and out of the cathode chamber of the fuel cell.

- 1 2. The fluid controlling assembly as defined in claim 1 wherein said adjustable
2 component regulates the rate of flow of oxygen into and out of said cathode chamber and
3 in a predetermined adjustment state is used to shut down the fuel cell by substantially
4 preventing oxygen from flowing into said fuel cell.

- 1 3. The fluid controlling assembly as defined in claim 1 further comprising:
2 (i) at least one rotatably mounted frame disposed adjacent an oxygen source
3 associated with a cathode side of said direct oxidation fuel cell;
4 (ii) a gas impermeable component comprised of a membrane that is disposed
5 within said frame such that said frame in a first position controls the rate of the
6 flow of oxygen into and out of the cathode chamber, and in a second position
7 substantially resists the flow of oxygen into the cathode chamber.

- 1 4. The fluid controlling assembly as defined in claim 1 further comprising a plurality
2 of frames rotatably mounted on hinges disposed over an oxygen source associated with
3 the cathode side of said fuel cell, and each said frame includes a gas impermeable
4 material disposed within the frame.

- 1 5. The fluid controlling assembly as defined in claim 1 wherein the direct oxidation
2 fuel cell is an air breathing fuel cell, said oxygen source is ambient air, and said one or
3 more frames are placed over the air breathing face of the fuel cell to control the flow of
4 ambient air into and out of the fuel cell.

1 6. The fluid controlling assembly as defined in claim 1 further comprising
2 a control system for variably actuating the position of said adjustable component
3 of said fluid controlling assembly.

1 7. A fluid controlling assembly for use in a direct oxidation fuel cell, comprising:
2 (i) a first component that includes an aperture disposed in a cathode chamber
3 of the direct oxidation fuel cell; and
4 (ii) a corresponding second component such that placement of the first
5 component relative to the second component results in an opening that permits the
6 flow of fluids therethrough, and when closed restricts the flow of fluids into the
7 cathode chamber.

1 8. The fluid controlling assembly as defined in claim 7 further comprising said first
2 and second components are generally planar components that include corresponding
3 apertures, which when aligned create openings and said first and second components can
4 be adjusted relative to one another to control the rate of fluid flow through said openings.

1 9. The fluid controlling assembly as defined in claim 8 further comprising said
2 apertures of said first and second components being lined with a gas permeable, liquid
3 impermeable film that controls the rate of flow of oxygen therethrough to control the
4 cathode reactions, yet restricts the flow of liquid water therethrough such that humidity is
5 maintained within the cathode chamber.

1 10. The fluid controlling assembly as defined in claim 7 further comprising a control
2 system for variably actuating the position of at least one of said first and second
3 components of said fluid controlling assembly.

1 11. A fluid controlling assembly for use with a direct oxidation fuel cell, comprising,
2 (A) a water control element substantially comprised of a porous, compressible
3 material such that when said material is under compression, its tortuosity increases such

4 that less water is permitted to flow away from the cathode aspect of the membrane
5 electrolyte of the direct oxidation fuel cell; and
6 (B) compression assembly that variably places said water control element
7 under pressure when it is desired to control the amount of water in said cathode chamber.

1 12. The fluid controlling assembly as defined in claim 11 further comprising
2 a control system for variably actuating the compression assembly.

1 13. A fluid controlling assembly for use with a direct oxidation fuel cell comprising
2 a water control element substantially comprised of an expandable material such
3 that when the expandable material is activated, it expands to maintain water near the
4 cathode aspect of the membrane electrolyte of the fuel cell.

1 14. The fluid controlling assembly as defined in claim 13 further comprising means
2 for compressing said water control element to release water to allow water to escape out
3 of the cathode chamber of the direct oxidation fuel cell.

1 15. The fluid controlling assembly as defined in claim 13 further comprising a control
2 system for variably actuating the means for compressing said water control element of
3 said fluid controlling assembly.

1 16. The fluid controlling assembly as defined in claim 13 further comprising a
2 plurality of water control elements interleaved between openings in said fluid controlling
3 assembly such that the rate of oxygen flow through said openings and the rate of water
4 escape from said cathode chamber is controlled by said water control elements.

1 17. The fluid controlling assembly as defined in claim 16 further comprising said
2 water control element being a flexible bladder disposed within a housing.

1 18. A fluid controlling assembly for use in a direct oxidation fuel cell comprising a
2 thin film of substantially liquid impermeable, gas permeable material disposed within the

3 cathode chamber of the direct oxidation fuel cell to control rates of flow of water and
4 oxygen in the cathode chamber.

1 19. The fluid controlling assembly as defined in claim 18 wherein said thin film
2 includes one or more slits therein which open when said thin film is stretched to create
3 apertures thereby allowing greater rate of oxygen flow into the cathode chamber and
4 allowing a greater water escape rate from of the cathode chamber in predetermined
5 operating circumstances.

1 20. A fluid controlling assembly for use in a direct oxidation fuel cell comprising a
2 first component that includes a plurality of rods that have one edge of a thin film of gas
3 permeable, liquid impermeable strip of material attached thereto; and
4 a corresponding second component that has rods to which a second edge of each said thin
5 film of gas permeable, liquid impermeable strip of material is attached and the rods of
6 said second component are offset from the rods of the first component such that
7 placement of the first component relative to the second component results in a closure of
8 the assembly that resists flow of oxygen into the chamber and when open, controls the
9 rate of flow of oxygen into the cathode chamber.

1 21. The fluid controlling assembly as defined in claim 20 further comprising
2 a control system for variably actuating the placement of said first and second
3 components.

1 22. A direct oxidation fuel cell comprising:
2 (A) a membrane electrolyte intimately interfacing with a catalyst layer along
3 each of membrane's major surfaces, being a catalyzed membrane electrolyte, having an
4 anode aspect and a cathode aspect;

5 (B) an anode catalyst is disposed in contact with an anode aspect of the
6 protonically conductive, electronically non-conductive membrane electrolyte;

- 7 (C) a cathode catalyst that is suitable for oxygen electro-reduction reactions
8 which is disposed in contact with a cathode aspect of the protonically conductive,
9 electronically non-conductive membrane electrolyte;
- 10 (D) a cathode fluid controlling assembly that controls the water escape rate of
11 the produced in said reactions, and which controls the rate of flow of oxygen into and out
12 a cathode chamber as needed for said reactions; and
- 13 (E) a load coupled across said fuel cell.

- 1 23. A direct oxidation fuel cell system comprised of:
- 2 (A) a membrane electrode assembly including:
- 3 i. a protonically conductive, electronically non-conductive membrane
4 electrolyte;
- 5 ii. an anode catalyst that is disposed in contact with an anode aspect of the
6 protonically conductive membrane electrolyte;
- 7 iii. a cathode catalyst that is suitable for oxygen electro reduction reactions
8 which is disposed in contact with a cathode aspect of the protonically
9 conductive, electronically non-conductive membrane electrolyte; and
- 10 iv. a cathode fluid controlling assembly that controls a water escape rate of
11 the water produced in said reactions and controls the rate of flow of oxygen
12 into and out a cathode chamber as needed for said reactions;
- 13 (B) a housing;
- 14 (C) a means by which electrical connections can be made;
- 15 (D) a means by which fuel can be introduced to the fuel cell;
- 16 (E) a fuel source; and
- 17 (F) an oxygen source.

- 1 24. A method of controlling the delivery of oxygen and the escape of water from the
2 cathode chamber of a direct oxidation fuel cell, including the steps of:
- 3 (A) providing an adjustable fluid controlling assembly that controls the
4 flow of oxygen into and out of said cathode chamber and maintains
5 water in proximity to a cathode aspect of the fuel cell; and

6 (B) variably actuating a member in said adjustable fluid controlling
7 assembly to regulate oxygen flow to said cathode aspect and to
8 maintain humidity within said cathode chamber.

1 25. The method as defined in claim 24 including the further step of variably actuating
2 said controlling assembly based upon one of the following:
3 operating characteristics of the fuel cell;
4 temperature of the fuel cell;
5 state of the fuel cell, being powered down or operating; and
6 manual operation.

1 26. The method as defined in claim 24 including the further step of shutting the fuel
2 cell down by intentionally blocking oxygen access to the cathode chamber.